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14. ABSTRACT The funds from this grant along those from other sources were used to support the 20 th International Congress of Theoretical and Applied Mechanics, which took place in Chicago, IL during 27 August - 2 September 2000. These international conferences have been held every four years since 1924, except during World War II, and this was only the third time it was in the United States. It is not an exaggeration to call them the 'Olympic Games' of the field of mechanics. The number of registered attendees was 1,431 from 66 countries, a record for this conference. With each submission being reviewed by 5-6 recognized authorities in the field, the quality of the presentations was extremely high. The acceptance rate was 56%, about the same as that of the best journals in the field. The Congress provided financial support of \$122,000 to 128 participants from 26 countries, which ranged from waived registration only to everything including lodging and airfare. It is hoped that the Federal agencies, university groups, professional societies, and private foundations that supported ICTAM 2000 financially took great pride in what by all accounts was a most successful event.					
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ICTAM2000

20th International Congress of Theoretical and Applied Mechanics

Chicago, 27 August - 2 September, 2000

Final report
Submitted by

Hassan Aref
PI and President of ICTAM2000

1. Background

The US mechanics community hosted *the* major conference in the field in Chicago last year: the 20th International Congress of Theoretical and Applied Mechanics, briefly referred to as ICTAM2000, was held at the Chicago Marriott Downtown from August 27 to September 2, 2000. It is not an exaggeration to call the international congresses of the International Union of Theoretical and Applied Mechanics (IUTAM) the 'Olympic Games' of the field of mechanics. The PI was President of ICTAM2000.

The congresses, in fact, predate the establishment of IUTAM itself. They have been held every four years, starting in 1924, in major cities around the world. The four prior congresses were held in Copenhagen (Denmark, 1984), Grenoble (France, 1988), Haifa (Israel, 1992) and Kyoto (Japan, 1996). It had been more than 30 years since an IUTAM Congress was held in the US: The 12th Congress took place in Palo Alto in 1968. One has to go back more than 60 years to the first congress held in the US, the 1938 congress at MIT. For many mechanics researchers in the US ICTAM2000 was the once-in-a-career occasion to host the world mechanics community. Given the sustained interest from different nations around the world to host these international congresses, it is unlikely that we will see an IUTAM congress in the US for decades to come.

A consortium of 13 universities was behind the invitation to hold ICTAM2000 in Chicago. The Consortium consisted of departments and programs at (in alphabetical order) Brown University, Cornell University, Illinois Institute of Technology, Iowa State University, Michigan State University, Ohio State University, University of Chicago, University of Illinois at Chicago, University of Illinois at Urbana-Champaign, University of Michigan, University of Minnesota, University of Notre Dame, and University of Wisconsin. This Consortium was assembled by the PI prior to the first presentations proposing Chicago as a venue for the 20th congress, which were made to the Congress Committee of IUTAM at its General Assembly in Amsterdam, The Netherlands, 1994. The nucleus of the Consortium was based on contacts of long standing through the Midwest Mechanics Seminar, a lecture series that dates back to 1958. Additional schools joined through personal contacts and interactions. For example, Cornell University, which has the only other Department of Theoretical and Applied Mechanics in the US, was contemplating development of a proposal on its own but decided to join the Chicago bid early on.

The formal invitation was issued to IUTAM by the US National Academy of Sciences upon recommendation of the National Committee on Theoretical and Applied Mechanics (USNC/TAM).

This committee, of which the PI is currently chair, represents 14 professional societies that have mechanics research as a major part of their research agenda. By the summer of 1996, when all formal proposals to host the Congress in 2000 were due, four nations had submitted such proposals: Germany, Poland, UK and USA.

IUTAM is dominated by European nation representatives. It was therefore expected that proposals from Europe would be most sympathetically received by the Congress Committee of IUTAM, the body that decides the venue of the congresses. Indeed, since the two prior congresses, the 18th and 19th, had been held outside Europe, in Haifa, Israel, and in Kyoto, Japan, respectively, there was considerable sentiment to bring the congress 'home' to Europe to celebrate the turn of the millennium. The venue of choice was Cambridge University, UK, a location that is unparalleled in the history of mechanics because of the many eminent mechanics who have worked there, starting with Isaac Newton. Unfortunately, the UK proposal did not have Cambridge as the site but was submitted from Leeds, which didn't carry nearly the same level of nostalgic appeal.

The German proposal was submitted from Göttingen and was intended to celebrate the 125 year anniversary of Prandtl's birth. Unfortunately, this came just as Prandtl's institute in Göttingen was being disbanded! Germany renewed its bid for the 2004 congress with Dresden as the site.

The Polish proposal argued that only once before had a congress been held in Eastern Europe: the 1972 congress was held in Moscow. This was and is a powerful argument, especially in light of the fact that it would be financially possible for many Former Soviet Union delegates to attend. Poland renewed its bid for the 2004 congress and was narrowly awarded the next congress. The proposed venue is Warsaw.

2. Format of the Congress

The format of the Congress followed the pattern of prior congresses. The entire week of August 27 -September 2 was used. Sunday, August 27, was primarily taken up with various committee meetings, including the first meeting of the Congress Committee, where site selection for 2004 was the main topic on the agenda.

The Congress started on Monday, August 28, with the Opening Ceremony and then the Opening Lecture presented by Professor J. R. Rice of Harvard University, one of just two plenary lectures of the Congress. (The other plenary lecture is the Closing Lecture.) The Opening Ceremony is available as Quicktime movies on the world wide web at the Congress website.

The technical presentations were arranged in either lecture sessions or 'seminar presentation sessions'. Contributed lecture papers in parallel sessions were 15 minutes long with 5 minutes for questions, discussion and changeover. There were up to 14 parallel lecture sessions at one time, which in view of the breadth of coverage of the Congress was not as bad as it might sound. Some lectures, the so-called 'Sectional Lectures', were scheduled in sessions with just 6 lectures in parallel. In all, 18 Sectional Lectures were invited. All invitations were quickly accepted by the authors attesting to the general prestige of the Congress.

The two-hour 'seminar presentation sessions' consisted of several parallel sessions during the

first hour in which each author gave a brief (3 minute) presentation of the content of his/her poster. This was followed by a plenary poster display session in one of the ballrooms during which the poster was open for discussion. Two such 'seminar presentation sessions' were scheduled, one on Tuesday and one on Thursday afternoon. They turned out to be very lively and productive. Several authors whose papers were presented in this way seemed very pleased with the format.

Six topical areas were singled out for special attention at ICTAM2000. These were: "Turbulent mixing", "Granular flows", "Electromagnetic processing of materials", "Damage and failure of composites", "Mechanics of foams and cellular materials", and "Vehicle system dynamics". These six topics were chosen to be balanced between fluid and solid mechanics. Several of them have an obvious interdisciplinary flavor. The six topics were treated in so-called mini-symposia, which consist of a mix of lectures and seminar presentations. The mini-symposia started off with three introductory lectures presented in parallel in 6 sessions on Monday and Tuesday. Each mini-symposium was organized by two co-chairs selected by IUTAM from the international mechanics community. The mini-symposium chairs were allowed to select one of the sectional lecturers, so that a mini-symposium in all could claim four of the 'quasi-plenary' lectures at the Congress. Additional papers pertaining to the mini-symposium were scheduled in the regular, parallel lecture sessions and in the seminar presentation sessions.

Wednesday afternoon was set aside for an excursion (and the second meeting of the General Assembly of IUTAM also takes place at this time). The Congress continued on Thursday with the Banquet being held that evening. We had reserved the main floor of the Chicago Museum of Science and Industry for the ICTAM2000 Banquet and had subsidized the tickets through donations from the 14 professional societies that are represented on USNC/TAM. About 1,100 participants attended the Banquet. The Congress concluded on Friday with the Closing Lecture and Closing Ceremony. The Closing Lecture was presented by Professor H. K. Moffatt of Cambridge University, Director of the Isaac Newton Institute, and the newly elected President of IUTAM. Wrap-up meetings of IUTAM's Bureau and the Executive Committee of the Congress Committee took place on Saturday, but the bulk of the delegates had departed by then.

As an innovation we held a *Science Teachers Day* at ICTAM2000 on the Thursday. High school teachers from Illinois were invited to the Congress site to hear special lectures on exciting topics in mechanics; to lunch with mechanics researchers from around the world; to view the poster displays in the afternoon; to receive various materials that may be useful to them in the classroom (such as press releases on individual sessions, and the Congress poster and description); and to participate in the evening Banquet at the Museum of Science and Industry. Some 65 teachers from all over the northern half of Illinois attended. By all accounts this event was very successful.

3. *Publications and announcements*

The congresses are announced to the international community using two printed announcements, the *First Announcement* and the *Final Announcement*. The *First Announcement* was finalized in Fall 1998. Distribution began at that time and continued until the *Final Announcement* was ready. Direct mailings were done to a list of attendees of the Kyoto congress with some additions, a membership list provided by ASCE's Engineering Mechanics Division, and to all members of Euromech through their newsletter. All pre-nominated session

chairs were sent copies of the *First Announcement* for enclosure with their letters soliciting submissions. Furthermore, a large number of *First Announcements* were distributed by contacting the organizers of conferences in mechanics during late 1998, all of 1999 and early 2000 and asking them to enclose a copy of this announcement with the registration materials for their meeting. In total about 15,000 copies of the *First Announcement* for ICTAM2000 were distributed to the international community.

The *Final Announcement* was available in Fall of 1999 and was distributed to a smaller number of individuals who had indicated an interest in attending and/or presenting at ICTAM2000. It was prepared in a format that allowed one side of it, when unfolded, to be posted for display, and so single copies were mailed to university departments and to conference organizers with a request that the announcement be posted in a prominent place.

For the first time in IUTAM's history extensive use was made of the world wide web for dissemination of practical and programmatic information regarding the Congress. The URL was/is <http://www.tam.uiuc.edu/ICTAM2000>. This website was created and is maintained by Professor James W. Phillips of the PI's department. Professor Phillips was Secretary-General of ICTAM2000 and was also the founding webmaster of IUTAM's main website at <http://www.iutam.org>, which has since been reconfigured as <http://www.iutam.net>.

Most of the information about ICTAM2000 is available on the website, which now contains, for example, digital movies of the Opening Ceremony. Additional materials of interest beyond the Congress, such as a picture of all attendees at the 1938 congress, listing all the names and all the presentations made at that time, are also available on the website.

For the first time in recent memory a poster was produced announcing the Congress. The poster is based on a watercolor, *Meters of Motion*, commissioned by the PI from Illinois artist Billy Morrow Jackson. It depicts some of the 'heros' of mechanics and IUTAM: Archimedes, Galileo, Newton, Euler, Lagrange, Prandtl, Taylor and von Kármán. Sophia Kovalevskaya appears, as do small portraits of past and present IUTAM officers and congress organizers. A color version of *Meters of Motion* and a description of what it depicts is available on the Congress website. One thousand copies of the poster were printed and distributed worldwide. The Illinois Alumni magazine picked up on the poster and used it as their cover story for one issue, and through this additional exposure several copies of the poster were ordered by schools, corporate research labs, and private individuals.

Publicity for many of the exciting topics to be discussed at ICTAM2000 was provided by a set of abstracts in layman's terms written by pre-nominated session chairs. These abstracts were collected in a booklet and distributed to science journalists and other representatives of the popular press. They were also made available to the teachers attending the *Science Teachers Day* and to other interested parties. The hope is that these abstracts will be useful starting points for articles in the popular press on aspects of the mechanical sciences.

4. *Scientific quality of the Congress*

We have already alluded to the prestige carried by the invited papers at ICTAM2000. Indeed, IUTAM maintains records of invited speakers for all their congresses, and an invitation to speak is

generally conferred only once during a career. Members of the Congress Committee, the main organizing body of the congresses, are not invited to present sectional lectures. Organizers of mini-symposia are generally discouraged from placing their own names on the program.

In order to solicit the best papers possible from the community at large, a long list of 'pre-nominated sessions' has been identified by IUTAM. For each of these sessions two (sometimes three) chairs have been identified from the world mechanics community. The chairs have been asked to help identify leading authors in the subject matter of their pre-nominated session. The pre-nominated session chairs are charged with inviting a number of individuals, typically 30-40, whose work they regard highly, to submit papers for consideration through the regular paper submission procedures of the Congress. It is hoped that through this vehicle leading authors in every field of mechanics are identified and encouraged to submit papers for presentation.

A paper submitted to ICTAM2000 consists of an abstract and a so-called extended summary. The abstract is a brief piece of about 150 words that is published in the Abstract Book upon acceptance. The extended summary is a longer piece, up to two pages, complete with illustrations and references, which describes the work in more detail. IUTAM guidelines indicate that work to be presented at a congress should not have appeared in the archival literature prior to the presentation. Hence, the extended summary serves as a kind of 'preprint' of the work intended for presentation. The extended summary is used only for paper selection purposes and is not published.

ICTAM2000 is among the most thoroughly peer-reviewed conferences in the mechanical sciences. A paper submitted for the Congress may be reviewed and commented upon by as many as seven individuals: First, the paper may be from a country that does national committee pre-selection of papers. Such a paper is scrutinized by at least one member of a national review committee. In the US this committee is appointed by USNC/TAM – other nations have analogous committees and procedures. Second, the paper is classified as belonging to one of the pre-nominated sessions – virtually all submissions to ICTAM2000 were so classified – and at least two, and in some cases three, chairs of this pre-nominated session are asked to comment on the suitability of the paper. Third, the paper is reviewed by the appropriate members of the International Papers Committee (IPC), a five-person committee appointed for each congress by IUTAM, i.e., two individuals for a fluid mechanics paper, three for a solid mechanics paper. A paper on an offbeat topic in mechanics (i.e., a topic that does not remotely fall within any of the pre-nominated sessions) from a country that does not do national pre-selection thus might be seen by only two referees (viz the two fluid mechanics members of the IPC) but fewer than a dozen papers of the 1,953 submissions to ICTAM2000 fell into this category. Most papers were seen and commented upon by 5-6 individuals. The refereeing and selection procedure for ICTAM2000 resulted in 64% of the submissions (with a firm restriction of one paper per presenting author) being invited for presentation. Of the invited papers 41% were accepted as seminar presentations, 59% as lecture presentations. Between acceptance and presentation there was some 'melt', particularly on the seminar presentations. Thus, in the end, of the 1,953 submitted papers 708 were presented as lectures and 379 as seminar/poster papers. This is an actual presentation rate of 56%, which is comparable to the publication rate of many of the best journals in the field. A table

summarizing papers received, accepted and presented by country will be found at the end of this report.

5. *Funding*

At the 19th Congress in Kyoto in 1996 our Japanese hosts displayed a magnificent list of contributors from government, private foundations and industry. Our main challenge was to have something similar to show.

The 13 universities in the host Consortium each provided \$5,000 in financial support to the Congress. In addition, University of Illinois President J. J. Stukel agreed to provide \$50,000 in support of the welcome reception on Monday evening, one of the two major social events of the Congress.

The professional societies represented on USNC/TAM were approached regarding financial support for the Congress. Each society was asked to contribute \$3,000. Most of the member societies rose to this challenges (although not always to the full amount requested).

Several appeals were made to private industry and to foundations that support science and engineering. For these appeals a small brochure that explains aspects of the congresses, IUTAM, the host Consortium, etc., was prepared. Unfortunately, the only result of this campaign was that The Chicago Engineers Foundation of the Union Club of Chicago agreed to contribute \$15,000 in support of *Science Teachers Day* at ICTAM2000, which was run, then, as a self-contained project within the Congress on a \$15,000 budget (mostly stipends to teachers and expenses for one invited speaker).

Proposals were sent to Federal agencies with a longstanding tradition of supporting research in mechanics. We had hoped to raise \$150,000 in participant support costs but came in far short of that goal. The agencies that did assist us, and the amounts of support obtained, were

National Science Foundation	\$24,000
Office of Naval Research	\$25,000
Air Force Office of Scientific Research	\$20,000
US Department of Energy	\$10,000

At its meeting in Gainesville, FL, in summer 1998 during the 13th US National Congress of Applied Mechanics, USNC/TAM voted *not* to approach Federal agencies for support of US attendees to ICTAM2000, but to let the organizers of ICTAM2000 handle all fund solicitations. Otherwise, every four years USNC/TAM would coordinate proposals to Federal agencies to support US participation in the international congress of IUTAM. Hence, some portion of the funds contributed to ICTAM2000 by Federal agencies through this proposal were made available to US participants. Operationally, any request received from the US was acted on favorably.

Two general categories required funding over and above what could be recovered from the registration fees for ICTAM2000. First, the ability to assist younger researchers to attend and present their work has always been a priority of the IUTAM congresses – and a responsibility of the host. Many excellent researchers in mechanics from the Former Soviet Union would simply not be able to attend unless we could help defray costs. Younger researchers, junior faculty,

postdocs and graduate students, from all nations including the US, are often not able to secure the financial resources to make a major international conference trip. For many younger researchers, in particular, ICTAM2000 may be their one chance in many years to meet an array of prominent researchers from other nations.

We provided \$122,000 of financial support to 128 participants from 26 nations. Support packages included everything from a waived registration to full support, including lodging and airfare, depending on the circumstances and request of the participant. Presence on the program was a prerequisite for support, although some students who helped with the organization of the Congress, e.g., by functioning as session aides, and a few session chairs who were senior members of the mechanics community, were also offered financial support. We managed to have 45 attendees from Russia, and several from countries such as Ukraine, Georgia, etc., and this gesture was very well received by the international community. The number of registered attendees was 1,431, a record for an international congress in recent times.

We were cognizant of our role as hosts on behalf of the US mechanics community. This congress, held at the turn of the millennium, was an opportunity to display, with pride and grace, the rising influence of the US in mechanics during the 20th century. We hope that the Federal agencies, university groups, professional societies, and private foundations that supported ICTAM2000 financially took pride in what by all accounts was a most successful event.

6. Conclusion

ICTAM2000 provided a unique opportunity for the US to host the World mechanical science and engineering community, an opportunity we have not had since 1968 and that we may not have again for decades to come. It came at an auspicious time at the turn of the millennium and the end of a century that has seen a profound rise in the sophistication, influence and stature of US research in mechanics. ICTAM2000 was a truly international gathering with strong participation from all the European countries, from China, Australia, Japan, India, and – to the extent we could help out financially – from the countries of the Former Soviet Union where there is a strong mechanical sciences tradition. All numbers associated with the Congress were records, from the number of submitted papers to the number of presentations to the number of registrants to the number of on-site orders of the proceedings volume.

Governor Ryan declared Monday, August 28, 2000, “Theoretical and Applied Mechanics Day” in Illinois, a remarkable gesture and something that we intend to continue celebrating.

Table: Summary of papers presented at ICTAM 2000

Columns in the Table give papers by country: submitted papers (Submitted), accepted as lecture (L Acc'd) and as seminar (S Acc'd), presented as lecture (L Prsntd) and as seminar (S Prsntd), invited (i.e., Sectional lectures, Opening and Closing lectures and the Introductory lectures of the mini-symposia), and total number of individuals registered (Regist'd). These are the official, final counts.

Country	Submitted	L Acc'd	S Acc'd	L Prsntd	S Prsntd	Invited	Regist'd
USA	619	300	184	298	132	15	587
Russia	142	30	28	23	19	1	48
Germany	128	50	43	46	36	2	101

France	123	61	37	58	31	4	116
Japan	113	45	34	45	31	3	94
China (PRC)	100	13	16	12	11		29
United Kingdom	90	53	26	51	18	5	83
Italy	62	24	13	21	5		36
Ukraine	41	5	8	3	3		5
Poland	40	12	9	12	8		25
Israel	36	18	11	17	10	2	33
India	34	5	2	4	2	1	8
Denmark	29	16	8	16	7	1	28
The Netherlands	29	16	10	16	5	1	28
Canada	26	7	8	7	6	1	23
Austria	25	17	3	17	3		23
Sweden	21	9	5	9	4		23
Brazil	20	2	6	2	4		6
Taiwan	19	1	4	1	2		6
Switzerland	18	14	3	15	3	1	24
Romania	17		5		3		2
Hong Kong	16	2	5	2	4		6
Czech Republic	15	1	3	1	2		4
Armenia	14						3
Bulgaria	12	2	3	2	1		3
Korea	12		4		4		9
Belarus	10		1				0
South Africa	10	3	2	2	2		7
Spain	10	3	4	3	1	1	5
Singapore	9	2	2	2	2		8
Belgium	8	3	2	3	2		6
Greece	8	3	2	3	1		5
Hungary	8	2	1	2	1		3
Egypt	7		1				0
Portugal	7	2	1	2			3
Australia	6	3	3	3	2		9
Ireland	6	1	2	1	2	1	5
Latvia	5	3		2			2
Norway	5	2	1	2	1		3
Finland	4	2	2	1	2		4
Uzbekistan	4						0
Yugoslavia	4		1		1		1
Mexico	3	1	1	1			1
Slovakia	3						2
Thailand	3		1				0
Turkey	3		1		1		1
Vietnam	3	1					0
Croatia	2						0
Estonia	2	1	1	1	1		2
Georgia	2		1		1		1
Guadeloupe FWI	2		1		1		1
Kyrgyzstan	2						0
Nigeria	2	1					0
Saudi Arabia	2		1		1		2

Slovenia	2		2		2		2
Argentina	1						0
Chile	1	1		1			1
Cuba	1		1		1		1
Iran	1						0
Jordan	1						0
Kazakhstan	1						0
Nepal	1	1		1			1
Papua New Guinea	1						0
Trinidad	1						0
Zimbabwe	1						0
New Zealand	0						1
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TOTALs	1953	738	513	708	379	39	1430